

peratures of 27° to 30° on the 18th, and on the morning of the 18th they were advised to prepare for a temperature of 25°, which implied a cane-splitting freeze.

The warnings were widely distributed, not only by the Bureau, but by private individuals interested in the sugar crop. The temperature on the morning of the 19th ranged from 22° to 29° in different parts of the sugar and truck growing region.

The following comment from The Daily Picayune of November 19, 1903, concerning the warnings, is of interest.

Sugar planters have been warned by the Weather Bureau to prepare for temperatures as low as 25°, and reports received seem to indicate that they are acting in accordance with the warnings and protecting the cane crop. A temperature of 25° so early in the season would damage the cane crop to the extent of millions of dollars unless protection is accomplished. Since sugar cane grows richer in sugar contents with every day that it is allowed to grow, many planters cut their cane only as fast as they can manufacture sugar. In some seasons grinding is completed without a freeze, and the cane harvested at the close of the season gives much greater production than that harvested at the opening of the season. With a feeling of certainty that he will be warned by the Weather Bureau of an approaching freeze in time to enable him to protect his crop, the planter lets his cane grow until warned by the United States Weather Service to protect his crop. The Weather Bureau has in the past saved millions of dollars to the sugar planter, for there has not been a freeze in recent years but what the lowest temperature which occurred has been announced in warnings issued twenty-four to thirty-six hours in advance of its occurrence.

I. M. Cline, District Forecaster.

CHICAGO FORECAST DISTRICT.

Cold waves.—The month was marked by moderate temperature throughout the first half. The first well-defined cold wave and winter type appeared in the extreme northwest on the morning of the 15th. It moved slowly southward and eastward, following an area of low barometer which had crossed the middle Rocky Mountain region from the Pacific coast. By the morning of the 16th, the cold was felt quite generally west of the Missouri Valley. It continued to increase in intensity, and by the morning of the 17th had overspread the entire district. Exceptionally cold weather prevailed in Montana and zero temperatures occurred in portions of North Dakota, South Dakota, and Minnesota. Warnings of the cold wave were sent to all points in the forecast district on the 15th, and all interests were advised that the first severe cold spell of the winter was approaching.

Storm warnings on the Lakes.—The weather on the Lakes was marked by frequent storms, more or less severe, and storm warnings were displayed many times during the month. The advices of the Weather Bureau were generally closely followed, and but two wrecks of consequence occurred.

The steamer *Waller L. Frost* went ashore on South Manitou Island during the storm of the 9th and 10th, and the vessel and cargo, valued at \$75,000, were a complete loss. The most serious wreck was that of the new steel steamer *J. P. Hutchinson*, which went ashore near Keweenaw Point on the night of November 29 in a northerly gale and snowstorm. The steamer missed the entrance to the Portage Lake canal and went on the rocks. It is badly damaged and may be a total loss. The vessel and cargo of flax seed are valued at nearly \$400,000. Storm warnings were displayed on Lake Superior for two days previous to this wreck, and danger signals were flying at Duluth when the vessel left port.

Snowstorms.—No general heavy snowstorms occurred during the month, but the considerable falls of snow were confined to the upper Lake region, and were due to the influence of the moist Lake winds. The Upper Michigan Peninsula was visited by several heavy snowstorms.

Considerable snow fell over a portion of the city of Chicago on the 26th. The maximum depth of snow reported was 11 inches at South Chicago. A fall of half an inch occurred in the downtown district, while west of Halsted street, a mile away, not even a flurry was seen during the entire day. The

observer at Port Huron states that a storm of a similar character visited his city on the same day, and another local snow-storm occurred in Port Huron on the 6th.—*H. J. Cox, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.

November was not only dry throughout the district, but unusually mild, except from the 16th to the 19th, during which period very low temperatures spread over the greater part of the district.

For several days prior to the 15th a deep low remained central in the Pacific northwest. The p. m. charts of the 14th gave indications of a southeastward movement, and on the morning of the 15th the depression was central in northern Colorado. A warning of a cold wave was then sent to points in Wyoming and eastern Colorado and of a moderate cold wave in southern Utah and northern Arizona. By the morning of the 16th a sharp fall in temperature had occurred in southern Utah and northern Arizona and strong anticyclonic conditions had developed over the British Northwest Territory, giving a steep gradient over the district and a decided fall in temperature on the middle-eastern slope, extending on the 17th to southern New Mexico. The warnings were timely and doubtless of considerable value to live stock interests.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

A rainless period of nearly two hundred days, with the exception of two days in October, was brought to a close by a storm of moderate intensity on November 4. Rain fell in generous amounts over central and northern California. Southeast storm warnings were displayed from the Southeast Farallon northward to Eureka on the morning of November 3. Southerly winds exceeding 40 miles occurred on the evening of November 3 and the morning of November 4. On November 11 the first well-marked coast storm of the winter occurred. Southeast storm warnings were displayed from Port Harford northward on the morning of November 11. The storm moved southward, as expected, to northern California and then rapidly eastward. Generous rain fell throughout central and northern California. High southerly winds were reported at nearly all stations north of the Tehachapi. Southeast storm warnings from San Francisco to Eureka were displayed on the morning of November 13 and continued on November 14. The warnings were amply verified. Southeast storm warnings were displayed on November 18 and were verified. A moderate disturbance moved southward along the northern coast, but, as in the case of the previous storm, was prevented by an area of high pressure over southern California from passing farther south.

A thunderstorm occurred at San Francisco on the morning of November 23. No rain fell during the month in southern California.—*Alexander G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

The weather in the North Pacific States during November was very stormy, with excessive precipitation and normal temperature. No extremely cold weather occurred and no cold-wave warnings were issued.

Several severe storms passed eastward over the district during the month, and timely warnings of their approach were given by this office. The storms of the 5th, 9th, 11th, and 14th were the most noteworthy, and unusually high winds accompanied their movement.

On the night of November 5 the steam schooner *Charles Nelson*, loaded with lumber and en route from Westport, Oreg., to San Pedro, foundered off the southern Oregon coast

and was abandoned by the crew. The *Nelson* left Astoria on November 3, and southeast storm warnings were displayed at all stations at the mouth of the Columbia River when the vessel put to sea. The captain reports encountering a severe storm on the night of November 4, which increased in energy and finally resulted in wrecking his vessel.

On November 9, the schooner *C. A. Thayer* went ashore at the entrance to Grays Harbor during the gale of that date. A gale of 90 miles an hour from the southeast occurred at North Head on the morning of the 9th. The masters of incoming vessels all report having experienced gales of hurricane force near the American coast, which did much damage in carrying away masts, rigging, hatches, lifeboats, etc. With the exception of the *Charles Nelson*, however, the disasters caused by the storms were almost exclusively confined to inward-bound shipping.

The forecasts for this district were made by District Forecaster Edward A. Beals from the 1st to the 5th, inclusive, and by Observer A. B. Wollaber during the remaining days of the month.—A. B. Wollaber, Acting District Forecaster.

RIVERS AND FLOODS.

No floods of consequence were reported during the month, and there was but a single stage above a danger line recorded, namely at Red Bluff, Cal., where a stage of 24.5 feet, 1.5 feet above the danger line was reached as a result of exceptionally heavy rains that lasted from the 19th to the 22d, inclusive, and amounted to about 5.50 inches. Warnings were issued on the 20th, advising the removal of live stock and care of the levees.

The stages of the Mississippi River, like those of the corresponding period of the preceding year, were above the average for the season below the mouth of the Missouri River, and they were also higher above the mouth of the Ohio River than during October. The Missouri River changed but little, while the Ohio was higher. The Tennessee was too low for navigation, except for the week from the 18th to the 24th, inclusive, and at the close of the month 85,000 cross-ties were lying on the bank of the river at Florence, Ala., awaiting sufficient water for shipment.

Floating ice was observed in the Mississippi River at St. Paul, Minn., on the 18th, reaching Hannibal, Mo., on the 25th, and continuing until the 30th. The Missouri River at Bismarck, N. Dak., froze over on the 17th. Floating ice had previously been seen as early as the 13th. The ice reached Pierre, S. D., on the 15th, and closed the river on the 18th. Running ice was observed at Sioux City, Iowa, from the 17th to the 19th, inclusive, and the river gage was frozen in on the former date.

The James River, Northwest, also froze over on the 17th, while the Red River of the North, at Moorhead, Minn., closed on the morning of the 27th. The Penobscot River, at Mattawamkeag, Me., closed on the 26th; the Merrimac, at Concord and Manchester, N. H., on the same date. The ice went out

two days later, however, at the latter place. The Connecticut River at Wells River, Vt., froze over on the 21st, and floating ice was quite plentiful at all points below, forming a small gorge above the bridge at Hartford, Conn., on the 28th.

The departure on the 30th of the steamboat *Dean Richmond*, from Albany, N. Y., marked the close of through navigation for the season on the Hudson River.

At the end of November, 1902, very little ice had been observed in the various rivers.

The highest and lowest water, mean stage, and monthly range at 183 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—H. C. Frankenfield, District Forecaster.

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	2, p. m.	54	114	9, p. m.	39	75	Miles. 3,050	Days. 7.0	Miles. 436	Miles. 18.1
II.....	8, a. m.	43	123	10, a. m.	35	85	2,150	2.0	1,075	44.8
III.....	12, p. m.	51	114	15, p. m.	35	76	2,450	3.0	816	34.0
IV.....	16, a. m.	54	114	22, a. m.	46	60	3,775	6.0	629	26.2
V.....	25, a. m.	50	97	28, a. m.	28	83	1,900	3.0	633	26.4
VI.....	28, a. m.	51	114	*1, a. m.	37	81	2,575	3.0	858	35.8
Sums.....							15,900	24.0	4,447	185.3
Mean of 6 paths.....							2,650		741	30.9
Mean of 24.0 days.....									662	27.6
Low areas.										
I.....	4, a. m.	48	89	6, a. m.	46	60	1,500	2.0	750	31.2
II.....	5, p. m.	41	70	8, a. m.	46	60	725	2.5	290	12.1
III.....	6, p. m.	54	114	10, p. m.	48	68	2,800	4.0	700	29.2
IV.....	9, p. m.	54	114	11, p. m.	48	86	1,800	2.0	900	37.5
V.....		43	109				1,700		850	35.4
VI.....	11, a. m.	47	123	13, a. m.	35	97	2,275	2.0	1,136	47.3
VII.....							1,900		950	39.6
VIII.....	14, a. m.	47	123	17, p. m.	48	68	3,100	3.5	886	36.9
IX.....	21, a. m.	48	125	25, a. m.	50	64	3,050	4.0	762	31.8
X.....	23, p. m.	37	117	25, p. m.	30	82	2,250	2.0	1,125	46.9
IX.....	27, a. m.	54	114	30, a. m.	42	80	2,225	3.0	742	30.9
					47	65	3,375		1,125	46.9
Sums.....							26,700	25.0	10,216	425.7
Mean of 12 paths.....							2,225		851	35.5
Mean of 25.0 days.....									1,068	44.5

* December.

For graphic presentation of the movements of these highs and lows see Charts I and II.—George E. Hunt, Chief Clerk, Forecast Division.

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions during November are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—The first half of the month was warm and favorable, but the latter half was much colder than the average. The rainfall was deficient, particularly in the central counties. A severe cold wave on 19th damaged recently sprouted wheat and oats and fall gardens, and killed some very late cotton on lowlands; cotton mostly marketed. About an average acreage of wheat and oats indicated, early sown doing well.—F. P. Chaffee.

Arizona.—Rainless weather prevailed throughout the entire month,

making, with the rainless weather of the greater portion of October, an exceptionally long dry spell. Temperatures averaged above normal. There was an abundance of feed on ranges, due to the good rains of the latter part of September, and this was well cured as hay by the dry weather. Stock was in excellent condition, but the supply of water was diminishing, causing fear of suffering unless rain came soon.—M. E. Blystone.

Arkansas.—The unusually cool and dry weather was favorable for gathering outstanding crops, but was too dry for plowing, seeding, and germination. Cotton picking well advanced, probably 80 per cent completed; the yield was light. Corn all gathered; yield average. Irish and sweet potatoes made good crops, and harvesting was nearly completed. Less than usual acreage sown to small grain. Pastures dried up and stock water was scarce, but an abundance of winter feed was secured and stock was generally thrifty.—Edward B. Richards.

California.—Weather conditions were nearly normal during the month,